MetroSim: Metroplex-Wide Flight Planning and Optimization

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Identification and Significance of Innovation

MetroSim is a Metroplex-based arrival, departure, and surface optimization. Linking with both the NASA-developed Traffic Management Advisor (TMA) tool as well as the NASA-developed System Oriented Runway Management (SORM) tool, MetroSim allows airport planners, traffic flow management experts, airline dispatchers, air traffic controllers, and pilots to reduce the uncertainty in operations planning, recover quickly from disruptive events, maintain high throughput even in adverse weather conditions, and handle the uncertainties associated with weather forecasts. MetroSim handles the scheduling of arrivals, departures, and surface movement simultaneously, using a suite of tools that interact in a distributed environment. Such a comprehensive scheduling system is unavailable in today's system.

TRL 1 at project inception, TRL 2 at end.
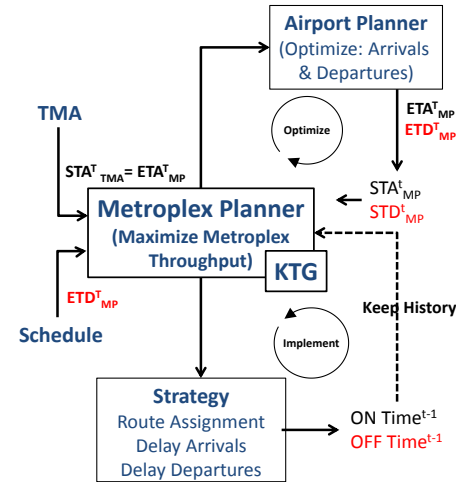
Technical Objectives and Work Plan

The primary objective of Phase 1 is to fully specify the Metroplex Planner and the Airport Planner, and demonstrate its feasibility by running a sample day and comparing that data to the actual performance for that day. Thus the objectives of Phase 1 are (1) develop a prototype of MetroSim, in a combination of the "Matlab" programming language and the Java programming language; (2) demonstrate that the prototype works for a sample day, by comparing what MetroSim would decide from a given day's flight sample to what actually occurred on that day.

Work Plan:

In order to meet these objectives, the following tasks comprise the work plan:

1. Fully specify the Metroplex Planner, and implement it as a prototype.
2. Fully specify the Combined Arrival and Departure Scheduler, which is one component of the Airport Planner, and implement it as a prototype.
3. Fully specify the Airport Surface Manager, which is the second component of the Airport Planner, and implement it as a prototype.
4. Run a sample day through the system, comparing its result to what actually happened on that day.

Potential NASA Commercial Applications

The MetroSim scheduler will allow NASA researchers to experiment with different concepts of operations for interval management, fuel management, arrival route structure, and even rule changes and reduced wake vortex separation standards. NASA can also use the tool as a driver for traffic in human-in-the-loop simulations. Finally, NASA can integrate MetroSim with its Traffic Management Advisor (TMA), allowing full flight optimization from the enroute through the terminal area.

Potential Non-NASA Commercial Applications

Other Government. We anticipate that MetroSim will eventually be tested in "shadow mode" in a backroom of a TRACON. This application falls in the domain of the Federal Aviation Administration.

Commercial. MetroSim can be used by airlines as a route planning tool, allowing them to experiment with different arrival and departure route choices on their flight plans, and assessing the fuel cost and timing of each route choice.

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